TECHNICAL DIGEST

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NORTHROP F-5

F-5 TECHNICAL DIGEST

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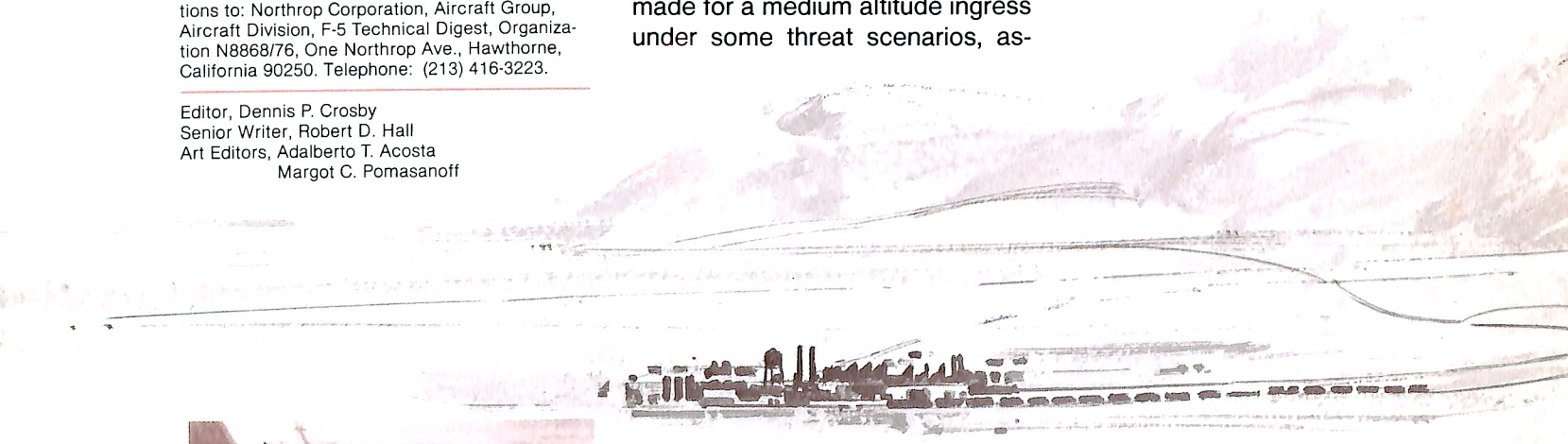
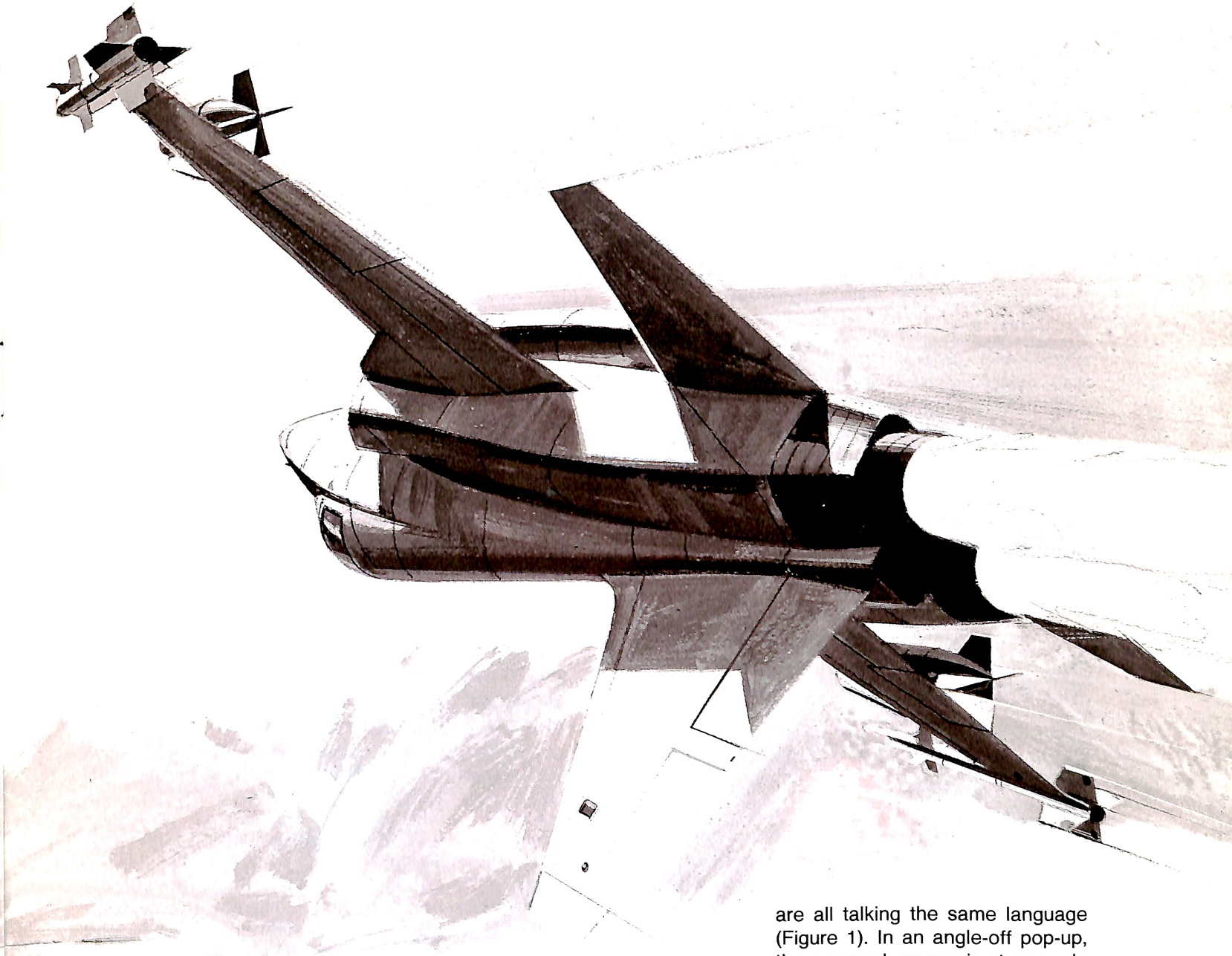
PART 1 POP-UP ATTACKS

As most of you know, pop-ups have received more and more emphasis in the tactical community over the past few years. The driving factor behind all this emphasis is the threat we expect to encounter. The current tactical mix of enemy defenses in a typical high-threat scenario has made many people lean toward a low-altitude ingress to the target area. The idea behind this low-altitude ingress is to avoid or at least minimize the effects of the majority of threats, and to gain some degree of deception and tactical surprise. I realize that there are two sides to every coin, and an effective argument could certainly be made for a medium altitude ingress under some threat scenarios, assuming effective ECM (electronic countermeasures). The decision as to what ingress altitude to use should untimately be based on a host of carefully weighed tactical mission planning factors. If a medium altitude ingress is suitable, use it. It's a lot easier! However, if the decision to go low is made, we must have a workable means of achieving planned release parameters while keeping the time we are exposed to the majority of the enemy defenses to a minimum. In essence, that's exactly what a pop-up attack is all about.



Cover Photo: A flight of two F-5s by Harlan Krug, Art Director, Aircraft Division, Graphics.



G. WRIGHT

As an overview, this article will cover basic considerations pertinent to the execution of angle-off and direct pop-ups, planning techniques for these attacks, navigation requirements, and repositioning maneuvers. Additionally, the importance of basic fighter maneuvering will be stressed throughout, because a thorough knowledge of these concepts and an ability to apply them is absolutely critical to the successful execution of any pop-up attack.

Let's take a look at a typical angle-off pop-up profile, and discuss the various points to make sure we are all talking the same language (Figure 1). In an angle-off pop-up, the approach course is at an angle from 15° to 90° either side of the final attack axis. The approach course angle-off will vary with the availability of a suitable IP and the planned climb angle, as well as other tactical considerations. This permits the pilot to acquire the target quickly and maintain visual contact throughout the pass. The pop-up point or PUP is a point over the ground from which the attack is initiated. Preplanned airspeed should be achieved as early as possible, but certainly not later than the pop-up point. That airspeed will vary with the specific deliveries, but generally between 500 and 550 knots indicated works well.

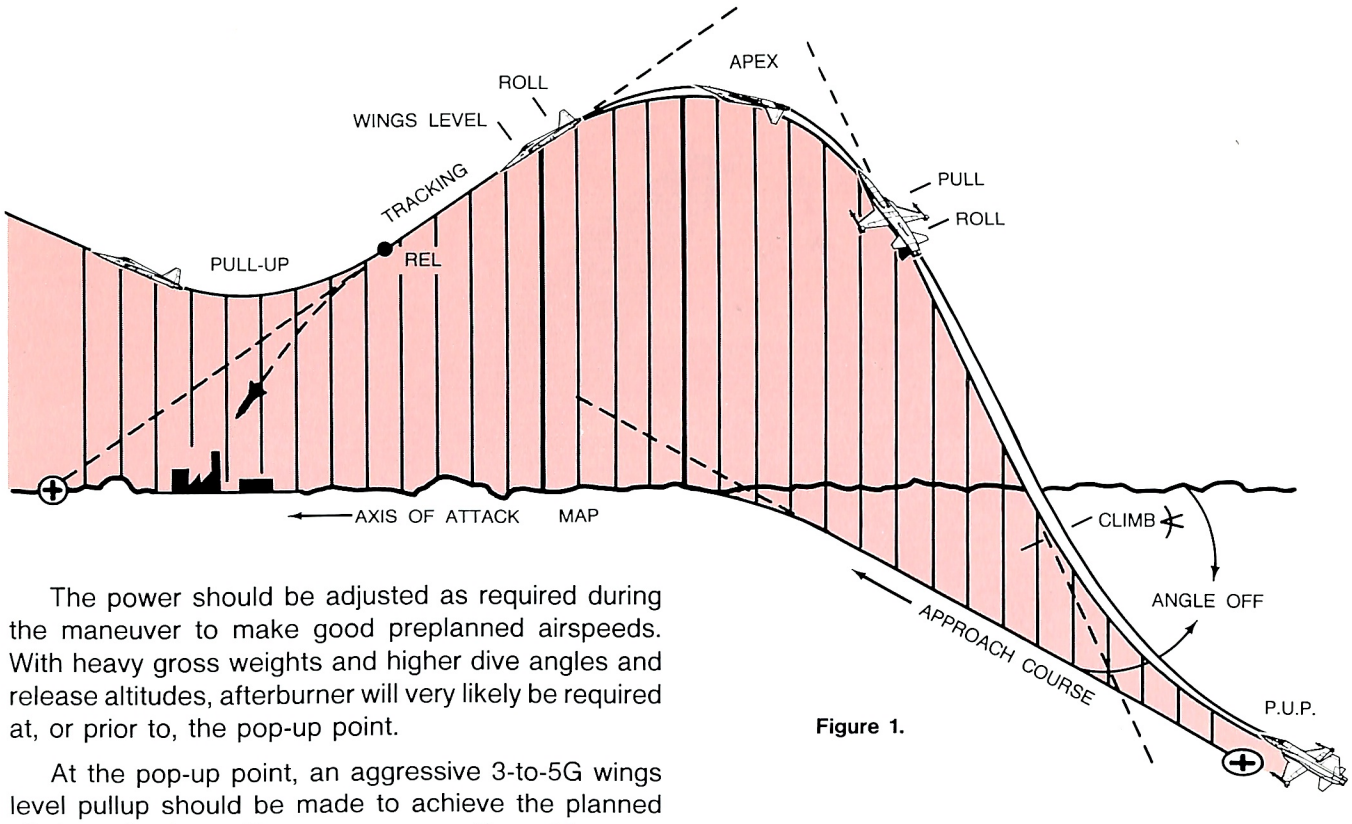


Figure 1.

The power should be adjusted as required during the maneuver to make good preplanned airspeeds. With heavy gross weights and higher dive angles and release altitudes, afterburner will very likely be required at, or prior to, the pop-up point.

At the pop-up point, an aggressive 3-to-5G wings level pullup should be made to achieve the planned climb angle. A curvilinear maneuver will provide some degree of unpredictability which will degrade an enemy gunner's tracking and lower his P_K (probability of kill). As soon as possible after initiation of the pop-up, begin to look for the target. Target acquisition is extremely critical to any ordnance delivery pass, but it's even more critical for a pop-up, due to the time compression factor. There are only a few seconds available to gain a tallyho on the target if, in fact, minimum exposure time is to be achieved. For that reason, extensive target area study is highly desirable.

If the target is a preplanned one, there is normally sufficient time prior to the flight briefing for all flight members to acquire a good mental picture of what they expect to see in the target area. In the flight briefing itself, heavy emphasis should be placed on the target area portion of the mission. There's no way to overplan in this area. If the target is not preplanned, or for whatever reasons there is not adequate time available for target area study, provisions of some sort must be made to give everyone in the flight the same mental picture of the target area. In some cases, this may have to be accomplished after takeoff. Regardless of when this target study takes place, it must take place if we expect to have any reasonable chance to acquire the target. Additionally, if severe target acquisition problems are anticipated, it may be desirable to use a jinking cruise climb instead of a pop-up to provide enough time to acquire the target. In the short run this may seem to increase exposure time, but in practice, experience has shown that it will actually decrease. This is due to the fact that there is a high probability of very late target acquisition when executing a minimum exposure time pop-up against a hard-to-find first-look target.

As with all tactical decisions, there are trade-offs that must be carefully made. In any case, we must be armed with a good mental picture of the target area if a minimum exposure pop-up is to be flown. Once in the pop, it is possible to rapidly area correlate by going from large terrain features to smaller ones that funnel your vision toward the specific target. Once again I'd like to emphasize the importance of preplanning with respect to the target area. Target acquisition is mandatory, but even beyond that, early target acquisition will greatly increase the probability of executing the attack successfully.

Once a tallyho on the target has been achieved, a rapid assessment of your position relative to the "track point" must be made. Then a decision must be made to either continue with the attack as planned, reposition, or abort the pass altogether. If the decision is to continue — at the preplanned pull-down altitude — execute a 2-5G pull-down to arrive at the track point, establishing aim off point/initial pipper placement and dive angle. This puts us on the proper dive plane or "wire." From that point on, the delivery problems are exactly the same as those of any other weapons delivery pass.

This decision to continue or reposition is the single most important factor in the entire pop-up problem. In order to make the proper decision, two things are required. The first is the ability to recognize the track point. This ability comes from experience with other types of delivery patterns. The track point in a pop-up delivery is exactly the same track point that must be achieved from a box pattern or a curvilinear pattern. It is the point on final at which we roll out wings level and begin to track the target. If a pilot doesn't have this ability to visualize the track point, he has no business flying pop-ups. A carefully planned building block approach to training is the way to ensure that a man has this ability. Begin with a box pattern until consistent performance is demonstrated. Then go on to curvilinear patterns using the same track point, but varying the base leg position and altitude. If he can visualize the track point and achieve it consistently from the curvilinear patterns, the first requirement has been achieved.

The next requirement is that the pilot must be able to decide whether or not he has sufficient turning room available to allow him to arrive at the track point with the proper dive angle, aim off point/initial pipper placement, and airspeed established. This analysis of turning room available versus turning room required to complete the attack is extremely critical. There is nothing magic or difficult about it. In fact, it is very basic — basic to all maneuvering that is done by tactical fighters. It is nothing more than basic fighter maneuvering applied to the bombing problem. Unfortunately, too many people in the fighter community think that BFM is something that only air-to-air units should do. I have heard several people say, "Air-to-ground units should be out learning to drop bombs, not how to dogfight. Our mission is beating the dirt, not killing MIG's." To these people, I would like to politely reply: "Baloney!" Basic fighter maneuvers are the tools that allow a fighter pilot to competently perform *EVERY* mission he must fly, including the air-to-ground mission. A good understanding of BFM is required in order to recognize spatial relationships. Having a good feel for what the airplane is doing without referring to the instruments frees the pilot to concentrate on other problems.

If an air threat is encountered during ingress in the target area, or on egress, it must be dealt with. A knowledge of BFM would certainly be helpful here. After the pop-up has been initiated and the target acquired, BFM is the vehicle that must be used to achieve the track point. The same angle-off, range, closure, energy state, and turning room problems that are encountered in a 1 V 1 BFM engagement are still present in the pop-up attack. The solution to these problems is properly applied basic fighter maneuvering. The man who has been well trained in BFM doesn't have to spend a lot of time worrying about how to get there from here. He *knows* how to get there, or perhaps more importantly, he recognizes when he can't get there because he has been trained to fly his airplane smoothly and competently throughout its entire flight regime. This ability gives him time to think about other things such as applying a correction for the winds or making an intelligent compensation for a small delivery error. This will obviously result in a much higher probability of destroying the target.

On the other hand, the man who hasn't been adequately trained in BFM has a very low probablility of killing the target. First of all, he may not recognize when he is at other than planned parameters or he may recognize it very late when there isn't time to do anything about it. Even if he does realize the fact that he isn't where he should be, he won't know what to do about it because he doesn't understand the principles of BFM and can't apply them. This is the man who will consistently miss the target in a typical first look tactical scenario. He is also the man most likely to kill himself.

As you know, we have experienced a number of accidents in the past few years during pop-up deliveries. Various factors have been cited by accident boards all trying to put their fingers on one thing: why did this accident happen, and what can we do to make sure it doesn't happen again? Restrictions have been imposed. Some people have simply stopped doing pop-ups. Abort criteria have been developed. Still we are having people run into the ground! Why? In all cases the reason people kill themselves in a pop-up delivery is because they fail to properly apply BFM! They don't recognize the preplanned release parameters. They don't recognize the track point. Finally, when turning room available becomes less than turning room required to pull out above the ground, they die. If only they could recognize the lack of turning room soon enough, they wouldn't run into the ground. How do we train people to recognize these things and react properly once that recognition occurs? A strong BFM training program, married to a well thought out building block approach to air-to-ground training, is the answer. When such training programs are implemented, there will be a dramatic improvement in bombing accuracy, as well as a decline in accident rates.

Up to this point we have only discussed angle-off pop-ups. There is another pop-up attack called a direct pop-up. As the name implies, the approach course to the pop-up point is within 15 degrees of the planned attack heading. At the pop-up point, a 3-5G pull is made, just as with the angle-off pop, to establish preplanned climb angle. Once the climb angle is established, an unloaded roll is made to an inverted position.

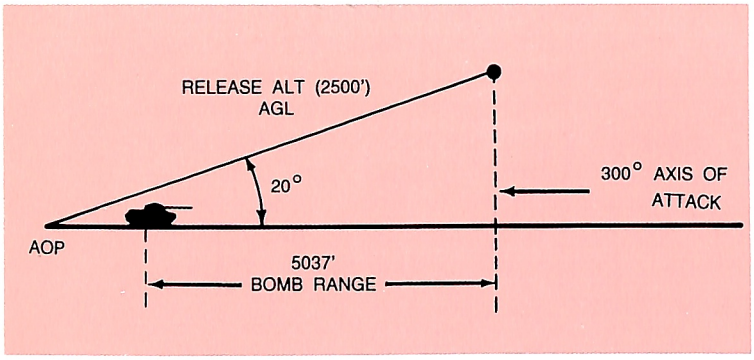


Figure 2.

This is necessary to acquire the target since it will be beneath the nose. Once the target is sighted, the same decision making process that was used in the angle-off pop must occur.

Can the track point be achieved with preplanned dive angle, aim off point/initial pipper placement, and airspeed established, or is a repositioning maneuver needed? If enough turning room is available to achieve the track point, continue to the preplanned pull-down altitude and initiate a pull-down to intercept the "wire." Roll out at the track point and complete the pass in standard fashion. The major difference in the execution of this maneuver is the roll to an inverted position. This must be done very shortly after the climb angle is established to provide time for target acquisition. During the inverted portion of the climb, a definite unloaded condition must be maintained to prevent apexing too low with inadequate turning room available to complete the maneuver as planned. In fact, if a constant climb angle is to be flown, sightly less than one negative G must be maintained while inverted.

The only advantage that a direct pop-up has over an angle-off pop-up is exposure time. It is possible to achieve slightly less exposure time with a direct pop-up. There are several significant disadvantages to this attack, however. Target acquisition is complicated because it is blanked out under the nose. Repositioning is more difficult if you should find yourself with inadequate turning room to complete the attack. There is less time available for repositioning because you are heading straight for the target. Additionally, there is less turning room available because you are making a single-plane pull-down rather than a multi-plane pull-down, as is done in the angle-off pop. Having inadequate turning room is one of the more common errors, and if the pass is continued, can result in an excessively steep dive angle. Once again, failure to recognize this situation developing can cause bad bombs or a situation from which recovery is impossible.

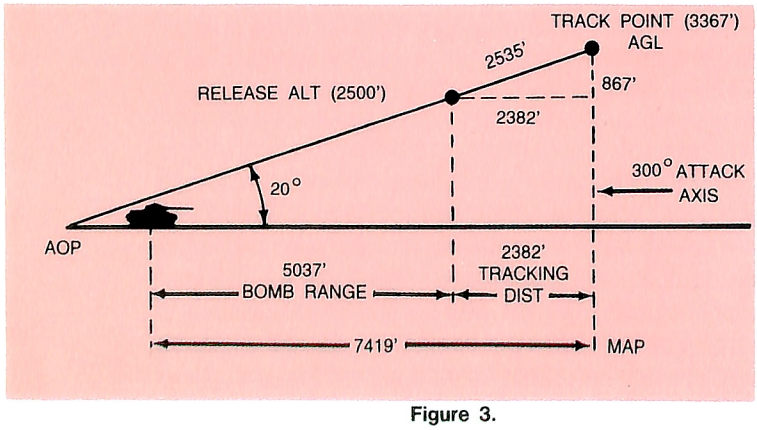


Figure 3.

On the other hand, the angle-off pop-up offers several advantages. It is a great deal more flexible than the direct pop-up. The target is much more easily acquired and is continuously visible up to the release point. Using the target as a reference, constant adjustments can be made, if necessary, to achieve preplanned release parameters. Minors errors caused by missing the optimum pop-up point can be easily corrected during the attack because there is more time and room available for these corrections. Overall, the advantages of the angle-off pop-up far outweigh the disadvantage of the slightly increased exposure time, in most instances.

Now that we've discussed the basics, let's turn our attention to planning of the attack. The approach that we'll take to pop-up planning is different than those used in the past. It is extremely important that you understand the planning techniques that we're going to discuss in the next few minutes. As I've already mentioned, a great deal of time and effort should be spent on planning the target area portion of the mission. All the good work that you've done to get your flight to the target area becomes meaningless if they don't execute properly during those critical few minutes. There is a direct relationship between the quality of your planning and the quality of your execution. You can't expect to execute better than you have planned. It just doesn't happen that way except in fairy tales. Additionally, the numbers that we are going to come up with must be understood. If you know where these numbers came from and what they really mean, your execution of the maneuver will improve. Unfortunately, there is no easy way to accomplish this planning. Even though it's not quick and easy, it is very important, so please stick with me for the next few minutes.

The best way to plan a pop-up attack is to begin at the target and work the problem backwards toward the IP. For illustration purposes we'll work a sample angle-off pop-up problem using these arbitrarily selected parameters:

- ORDNANCE - MK 82 LDGP
- RELEASE AIRSPEED - 520 KTAS
- RELEASE ALTITUDE - 2500 feet AGL
- DIVE ANGLE - 20 DEGREES
- TRACKING TIME - 3 SECONDS

The first step is to draw the basic bombing problem to include the target, axis of attack, dive angle, pickle altitude, bomb range, and aim-off point. The bomb range can be taken from the Dash 34 ballistics tables for direct deliveries. Using the tangent of 20 degrees and the known pickle altitude above ground level of 2500 feet, we can determine the ground range. For the set of parameters we have chosen using a manual delivery, the basic bombing triangle is depicted in Figure 2.

To the basic bombing problem, add some amount of tracking time on final. Once again this is an arbitary decision that must be based on the tactical situation that is anticipated. For this problem three seconds was selected. The depiction now looks like Figure 3.

The computations involved to construct this triangle are:

1. Determine the average true airspeed from roll out to release, and multiply that by 1.69. This yields a velocity in feet per second of 845.
2. Next multiply 845 feet per second by three seconds. This gives us the distance that is covered in the air during the tracking interval.
3. To find the distance over the ground that is covered during tracking, we can use the dive angle versus distance chart in the Dash 34, or trigonometry.
4. Multiplying the cosine of 20 degrees by tracking distance of 2535 feet gives us 2382 feet (the ground distance covered during tracking).

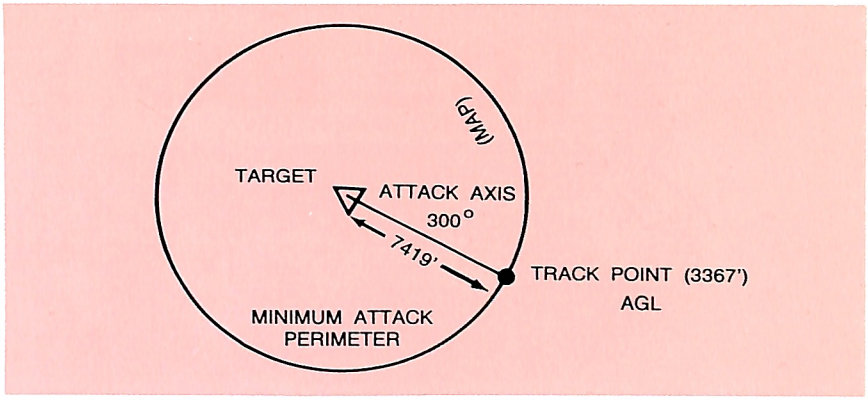
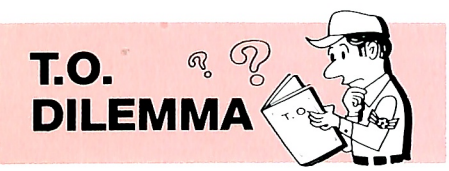


Figure 4.

5. We can also find the altitude lost during tracking by using trigonometry. Multiply the sine of 20 degrees by 2535 feet (tracking slant range covered in the air). This gives us 867 feet. (If you don't know a sine from a square root, you can use the dive angle versus distance chart to find all the numbers above.)

We now know that tracking should begin at 3367 feet AGL. That's our track altitude. We also know that tracking should begin at a point over the ground that is 7419 feet from the target. This point is referred to as the Minimum Attack Perimeter (MAP). In order to track that target for three seconds and then pickle at 2500 feet AGL, the airplane must arrive at a point 7419 feet from the target at 3367 feet AGL with the aircraft nose on the aim-off point and 20 degrees of dive established. A circle may be drawn around the target with a 7419 foot radius to depict the MAP, since it will not vary with attack heading in a no-wind situation (Figure 4.)

EDITORS NOTE — Due to the length of this article, it is necessary to stop at this point. In next month's issue we will conclude the pop-up planning article beginning with turn radius solution.

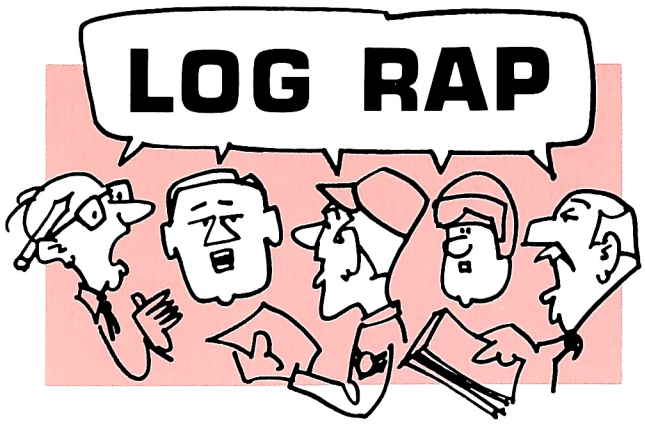


REFERENCE: T.O. 11F1-APQ159-28-1 dated 5 May 1978, page 4-5, TN-017, P/N 634300-305, Program A 8416 M Receiver Transmitter LRU. When TN-017 fails it goes to job routine TN-530 which says "short on 15 volt buss." Diagnostic does not include A1 and A2 as a possible cause. Recommend change TN-530 to read as a possible cause: F15 A1 and A2.

T.O. COMMENTS: Northrop Engineering agrees to take the following corrective actions: Since test No. 530 now contains the statement: "remove A2P1 from A10J4 on UUT," an additional statement will be added to read "remove A1P1 from A10J4 on UUT." This will disconnect the A1 module from the 15V buss. It must be noted that test No. 530 sub-routine "018, REPL, N,U" instructs the operator to reinstall circuit cards and connectors one at a time. This change will be incorporated into the manual upon Engineering release.

REFERENCE: T.O. 33D7-61-37-1 dated 6 Apr 1982, page 6-133, figure 6-15, P/N 663100-1/-301 Interface, RF. Pin 52 of P1 goes to U3 Pin 7. This should be changed to show this wire going to Pin 7 of U8.

T.O. COMMENTS: Supplier Accessory Manuals concurs in the recommended change. The correction will be made in chg 2 of subject T.O. Estimated release date is Nov 1983.



But What About Those Other Numbers?

John A. Was • Logistics Specialist

Most of us who use the MCRL-1 (Master Cross Reference List-Part 1) use it for the simple conversion of a part number, or reference number, to a National Stock Number — and reasonably so! That is the basic usage. But how many of us really know all the other data that's given us in this document? And how significant is that other data?

Just the other day one of our engineers came by and asked for some help in translating a part number to a stock number. Simple task for a "supply type"; so I complied in a very quick and autocratic manner by showing him our microfiche and supplying his info. He was grateful — as engineers should be to "loggies," — but as he looked over my shoulder at the microfiche reader, he said, "But what about those other numbers?" Ya just can't trust engineers to be satisfied with what they ask for. They always gotta know more.

As I began to explain some of the other columns of the MCRL-1 it occurred to me that it had been a long time since I really analyzed the other information that it provides. And I have to admit I was a bit rusty. I guess it happens to a lot of us who use a publication for one purpose and overlook a lot of data that is right before us but not seen. The old adage of the forest and the trees. This made me wonder how may others are guilty of misusing this valuable tool. And to prove to my engineer friend that not all loggies are dummies I promised to write this article.

Taking a picture of one frame of the microfiche slides shown in Figure 1, let's make a column-by-column analysis. In this example I've given an Alpha (letter) designation to each of the columns. Thus:

A. This is the microfiche frame and line number on the frame.

B. REF. NO. — This is *usually* the part number of the item being identified. It can also be a drawing number, model number, type number, source control document number, specification number, or even a trade name. The reference number is used to identify or partially identify the item in question.

C. FSCM. This is the Federal Supply Code for Manufacturers. While the title suggests a manufacturer, this is sometimes misleading. The code has other meanings such as:

1. Manufacturer
2. Vendor who supplies the item to the government but does not necessarily manufacture it. (Usually an alpha code is in second position.)
3. Government agencies who manufacture the item.
4. Government agencies who control the design of the item.
5. Government agencies who control the development of specifications and standards.
6. Government specification and standards per se.
7. NATO manufacturers (alpha in first position).

D. NSN. The assigned stock number consisting of the four-digit Federal Supply Class (FSC) and the nine-digit National Item Identification Number (NIIN).

E. ISC. The Item Standardization Code will relate whether the item is or is not authorized for procurement. Let's look at some of the codes used in our example in Figure 1:

Code 5 = An item authorized for procurement that has not yet been subject to item standardization.

Code 6 = An item authorized for procurement that is in a specific FSC or Item Grouping.

Code 2 = An item authorized for procurement which does not replace an item not authorized for procurement.

Code C = An item authorized for procurement.

F. RNVC. The Reference Number Variation Code is used to explain how thoroughly a reference (part) number describes an item. Again, take a look at Figure 1 for some examples:

Code 1. Non-identifying. Do not order on the basis of code 1 reference (part) number. Research further.

Code 2. Item identifying. The reference (part) number alone is enough to know exactly what the item is.

Code 9. Cancelled/obsolete reference (part) number. Further research required.

G. RNCC. The Reference Number Category Code designates the relationship of a reference number to the item of supply. Use Figure 1 for our example:

Code 3. This is the primary number used to identify an item of production by the manufacturer which controls the design and production of the item.

Code 5. Secondary reference. Any additional number assigned to an item by a commercial or government organization which represents the same item to which the NSN was assigned.

Code D. This is a Drawing Reference number and will not be used in item of supply determination.

H. SADC. The Service/Agency Designation Code is not usually of significance to most of us in the field. It is used to identify inter-relationships between reference number, NSN, and service agency (Army, Navy, Air Force, etc).

I. DA. The Description Availability code. If the field is left blank it means that a description of the item is available in DLSC files and will appear in Identification List (IL) publications. If "N" appears it means that no complete description is available.

J. ITEM NAME. The first 15 characters of the basic noun or noun-phrase that will describe the item by nomenclature.

The MCRL-1 is constructed in reference (Part) Number sequence. An easy way to remember the sequence is:

Space

Dash

Letter

Number

A B	C	D	E	F	G	H	I	J
D09 REF. NO.	FSCM	NSN	ISC	RNVC	RNCC	SADC	DA	ITEM NAME
A-9782-M-73A ASSY 6R8IM	63686	4820-01-115-1354	5	1	3			VALVE, GATE
A-9782-M-73A ASSY GR8INL1	03950	4820-01-115-1354	5	1	5			VALVE, GATE
A-9783	41947	5360-01-141-9030	5	2	3			SPRING, HELICAL
A-979064	96259	4820-01-053-9213	5	2	3			CARTRIDGE, VALVE
A-9793-PT	01930	5340-01-088-5772	5	9	5			CATCH, MAGNETIC
A-98	89875	7690-01-158-4343	6	2	3			LABEL
A-9823-11	72914	6220-01-124-1308	5	2	3			LENS, LIGHT
A-9834	28199	5330-01-020-6930	5	2	5			GASKET
A-9844	89925	5330-01-083-1529	5	2	3		N	GASKET
A-9846-1	72914	5970-00-410-6582	6	2	3			INSULATOR, DISK
A-98585	28873	4820-01-105-7490	5	2	3		N	DRAIN, VALVE
A-987	28569	6625-00-627-2860* 6625-00-717-6267	5	2	3			MULTIMETER, REPL
A-988	19631	6630-00-420-0507	2	2	3			TEST KIT, ALKACI
A-9882 AND A-9848	99565	4820-01-159-8767	5	9	D			STEM, FLUID VALVE
A-9886	99565	4820-01-154-1235	5	9	D			VALVE, CHECK
A-9886 12D-SS-R 2 1/2SN	99565	4820-01-154-1235	5	2	3			VALVE, CHECK
A-9897	28199	3040-01-161-2708	5	9	D			SHAFT, SHOULDERE
A-9900	89925	5330-01-083-3895	5	2	3			GASKET
A-9900-1	72914	6220-00-623-2337	2	2	3			INDICATOR, LIGHT
A-9906-2	72914	6240-00-752-1944* 6210-00-474-4197	2	2	3			LAMP, INCANDESCE
A-991	74063	5945-00-992-0618	6	2	3			RELAY, ELECTROMA
A-991-049	07332	2010-01-149-0996	5	2	3		N	RESISTANCE, TEST
A-991-050	07332	5940-01-147-5352	5	2	3			TERMINAL BOARD
A-9911V-2	57846	3040-01-077-1200	5	2	3			PACKING, CYLINDE
A-9911V-9	57846	3040-01-067-4819	5	2	3			PACKING, CYLINDE
A-9921-1	72914	6220-00-761-9520	C	2	3			WICK OIL, LIGHT

Figure 1.

For Example:

S A0440	T - 01437
S - A04381	TA76043
SA 31482	T00A7
T 104	301X8

We've had a look at just one of the management tools used in the day-to-day supply business. If I were to support a weapon system or an integral part of a weapon system, there are nine basic publications I would insist upon:

1. MCRL-1 Master Cross Reference List (P/N to NSN)
2. MCRL-2 Master Cross Reference List (NSN to P/N)
3. ML-C Consolidated Management Data List
4. IL Identification List
5. H4-1 Federal Supply Code for Manufacturers (Name to Code)
6. H4-2 Federal Supply Code for Manufacturers (Code to Name)
7. I&SG Interchangeability and Substitution Grouping
8. SNUD Stock Number User Directory
9. IPB The -4 Series T.O.'s of major weapon system

There isn't any real secret about interpretation of the data we've just covered. It's all contained in the "Introduction" section of each of the microfiche. Problem is that many of us don't take the time to read and understand the info, and we sometimes end up ordering stuff that's no longer good or authorized. There's one good thing about engineers: They — forget it!

We at Northrop recognize that some of our customers are new in the USAF logistics business and that some have had personnel transitions that may have left some blank spaces to fill. We *know* that we support aircraft performance, but we are also dedicated to assist in supply proficiency.

In this article we talked only about the MCRL-1, but our Provisioning Support Services Department (Orgn. 8853/76) has put together a brochure that gives a good explanation of 8 of the nine publications I mentioned above. I believe it can be of real value as an OJT Tool and a good refresher mechanism for the old-timers. If you would like a copy of the brochure, write our editor and ask for "THE BASIC TOOLS OF CATALOGING RESEARCH (NATIONAL STOCK NUMBER AND RELATED DATA)", dated 21 November 1983.

In our description of the MCRL-1 there are four elements of data that are significant to item management that are *not* contained in the MCRL-1. The first six respondents who can accurately define those four missing elements will be recognized in a future issue of the Tech Digest.

Let's Get THE WHOLE PICTURE!

Bill Lewis • Senior Engineering Specialist, Emerson Electric Co.

EDITOR'S NOTE: Bill is the Emerson Radar Tech Rep working with Northrop.

Todays's radar systems have become more automated than ever before, requiring less and less pilot workload. Although the workload has decreased, radar systems still require some manual inputs and visual interpretation to function properly and efficiently. The F-5 family of radars is no exception to this rule, with indicator adjustments being critical. Since not all F-5 pilots have had experience with the newer C.R.T. Video Indicator for the APQ-159 radar (see Figure 1), I thought that I would give you a brief pre-flight set-up procedure to ensure optimum performance.

- Place the system in the STANDBY mode and allow the indicator to time in with radar cursors displayed.
- Turn BRIGHT and CONT (contrast) controls fully counterclockwise.
- Place the RADAR/EO switch to EO (electro-optical) and the indicator TEST switch to position 1.
- Turn BRIGHT control clockwise just until a background illumination is seen, then back off (counterclockwise) until the illumination is just below the visual threshold. (This control sets the "black" level for the screen and should not need to be changed unless ambient light levels change significantly.)

- Turn up (clockwise) the CONT control until *all eight* shades of grey on the EO test pattern are clearly discernible (see Figure 2). (This setting may change with a significant change in ambient illumination.)
- Place the indicator TEST switch to OFF and the RADAR/EO switch to RADAR.
- Adjust the SYMBOL control for comfortable viewing level.
- Place the system in OPERATE and, after the transmitter times in, adjust the RDR VIDEO control so that six to ten "noise paints" are noted in the 10 Mile SEARCH mode. Ensure that the PER (persistence) control is fully counterclockwise and that the antenna is looking into a ground clutter free area.

It may be necessary to increase the contrast setting slightly to ensure that the lightest shade of grey noise paint is being seen on the scope. This will allow you to achieve maximum detection without setting the RDR VIDEO control too high, thus causing "noise lock-ons." Obviously, the interaction between the BRIGHT, CONT, and RDR VIDEO controls makes proper adjustment a must for optimum system performance. It is suggested that if you encounter a situation where you know that a target is in a given area but your radar does not indicate that target, you increase the contrast slightly before you try increasing the RDR VIDEO. This again will help to minimize spurious "noise lock-ons."

As a further note of caution, care should be taken whenever adjusting the indicator controls, either operationally or during maintenance testing. These control knobs and the related controls are physically small due to packaging constraints and have a maximum turning resistance of only six inch-ounces. They are therefore easily damaged if torqued too strongly into an end-stop. The RDR VIDEO potentiometer is the most susceptible to this type of damage due to its frequency of adjustment. There are certain maintenance test procedures (particularly relating to the E8205 A.T.E.) which requires turning this potentiometer knob from one end-stop to the other. Particular care should be taken during these procedures to preclude overtorquing. Remember, due to its 2 1/2 turn construction, there is never an operational reason to turn the RDR VIDEO control into either end-stop.

A bit of care taken to ensure proper adjustment during pre-flight set-up of this radar, and a soft touch while making in-flight adjustments, will result in a reliable piece of equipment which will keep your Tiger's vision 20/20.

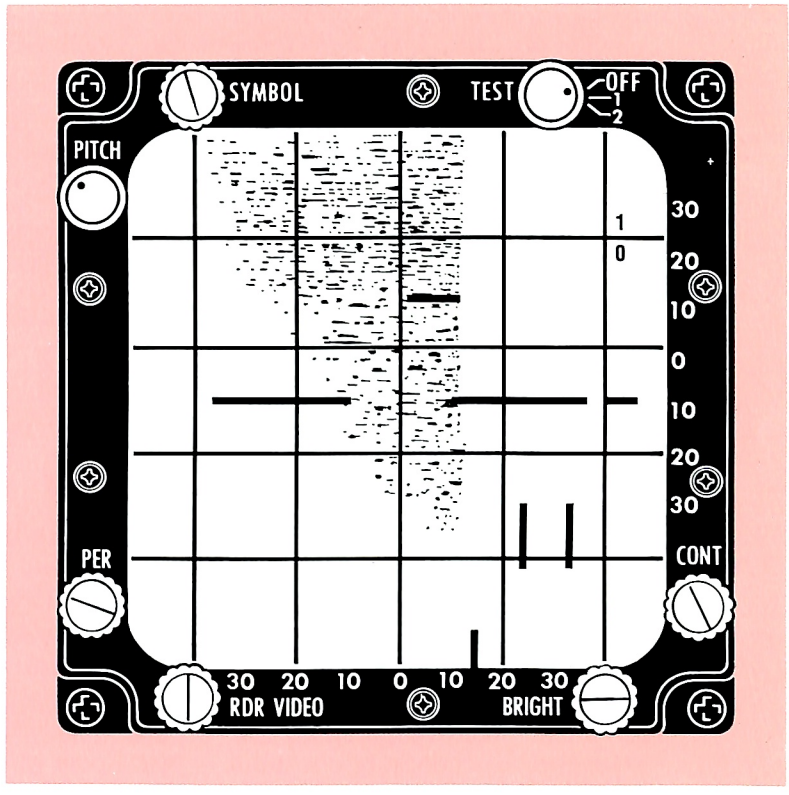


Figure 1. APQ-159 C.R.T. Video Indicator

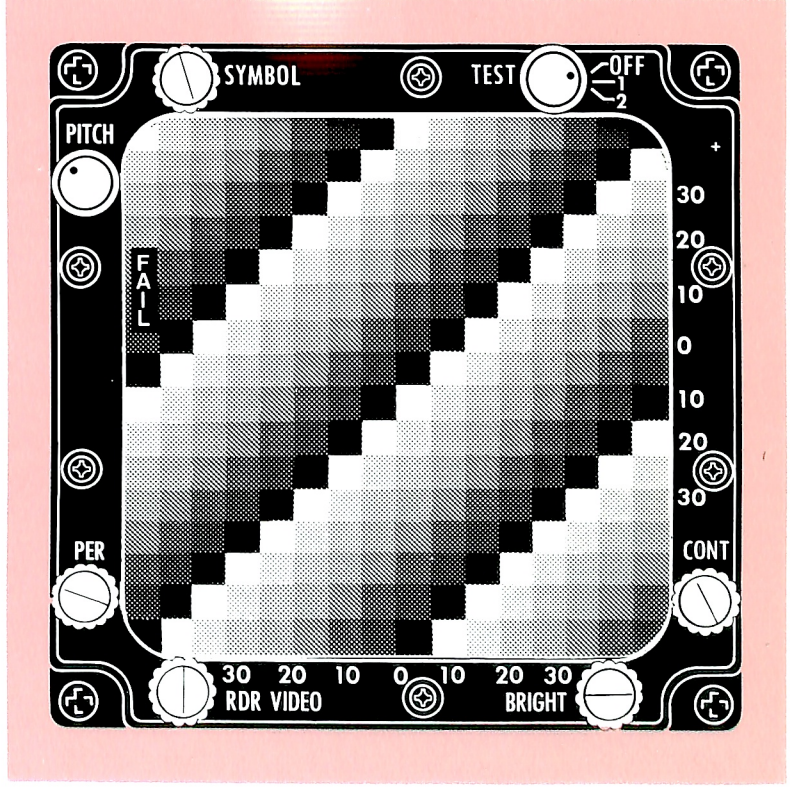


Figure 2. E.O. Test Pattern

What You Don't Know or Don't Do Can Hurt You

Brian P. Lauffer and Bob O'Bryan • Life Support Specialists

The art of surviving in the wilderness is one you may be forced to learn by self-teaching, but it comes easier if planned with an experienced instructor. It's easier when the experience is one from which you can escape by simply walking away. The worst time to try to learn how to survive is when your life depends on it, when you're scared, hurt, lost, cold, thirsty, hungry, exhausted and, if that's not enough, alone.

The average time for successful rescue of downed crewmen is seven hours. Within the first hour of Rescue Personnel becoming aware of your situation, a full scale search is underway and everything that can be done to find you is being done, but your recovery is based on several facts and some basic survival truths.

One very important and obvious fact is the extent of any injury you receive during the survival situation. Being injured is unpleasant to think about, but it's better to learn now how to quickly stop serious bleeding, immobilize an injured limb, dress wounds and treat burns rather than wait until it is life-threatening. A downed crewman's first concern is treatment of injuries. The survival manual, AFM 64-5, covers this treatment in basic terms on pages 2-2 thru 2-9 (see Fig. 1), but you may want more information than it contains. Read those pages and see if that's enough information about this vital subject to satisfy you. Know what is in your first aid kit and how to use it.

Next on your priority list of action will be to tell everyone and anyone where you are. If your parachute has an emergency locator beacon (do you know where it is and how it works?) it has been sending a distress signal since the chute opened. The beacon's signal is line-of-sight, so get it to high ground if necessary and if you can. You must turn it off to use your emergency radio from the survival kit. Do you know how to get the beacon out of your chute and turn it off? Don't forget to remove the flexible antenna from the pack and

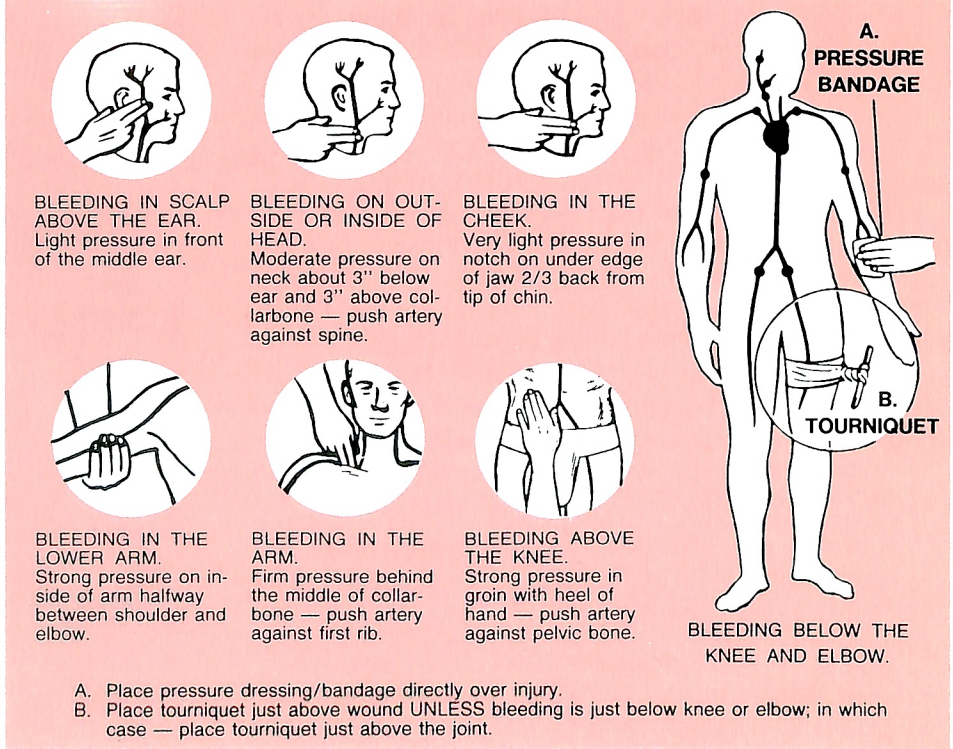

BLEEDING IN SCALP ABOVE THE EAR.
Light pressure in front of the middle ear.
BLEEDING ON OUTSIDE OR INSIDE OF HEAD.
Moderate pressure on neck about 3" below ear and 3" above collarbone — push artery against spine.
BLEEDING IN THE CHEEK.
Very light pressure in notch on under edge of jaw 2/3 back from tip of chin.
BLEEDING IN THE LOWER ARM.
Strong pressure on inside of arm halfway between shoulder and elbow.
BLEEDING IN THE ARM.
Firm pressure behind the middle of collarbone — push artery against first rib.
BLEEDING ABOVE THE KNEE.
Strong pressure in groin with heel of hand — push artery against pelvic bone.
A. PRESSURE BANDAGE
B. TOURNIQUET
BLEEDING BELOW THE KNEE AND ELBOW.
A. Place pressure dressing/bandage directly over injury.
B. Place tourniquet just above wound UNLESS bleeding is just below knee or elbow; in which case — place tourniquet just above the joint.

Figure 1.

keep it handy in case you break the telescopic one. Do you know how to get the flexible antenna out of the parachute?

The survival kit has a number of items in it for you to use to draw attention, which is exactly what you will be doing until the moment of your rescue. The emergency radio is important for this, of course. Can you operate it with one hand? Either hand? In the dark? It has a Morse code system with the full code on the radio's backside. Have you practiced using it?

Another valuable signal tool is the signal mirror. Its flash has been seen for 30 miles, and its power source is unlimited. Can you flash SOS with it? It is line-of-sight also, but anywhere sunlight can get in, the flash can get out. Even in forested areas, keep flashing at every possible moment. It will also provide a means to check your face and head for injury.

The radio and signal mirror may be line-of-sight but the whistle isn't. The sound of a whistle will carry far beyond the range of a shouting human voice, and is a very distinct sound not found in nature, especially when blown in three short blasts every few minutes. In a sense, it too has an unlimited power source. Anyone in a survival situation who does not hang it around his neck and blow it often is forgetting or ignoring a good survival technique. There may be someone within a few hundred yards that cannot see your signal mirror flash or hear your radio transmissions. The wilderness is not always empty of humans, and they can get into the most remote areas.

There are a number of flares in the survival kit: they are day/night smoke/flare and pengun type. Is there a best time to fire one? Should you wait until you hear an aircraft or see someone? Should you load the pengun and have it handy at all times? Will a shot from

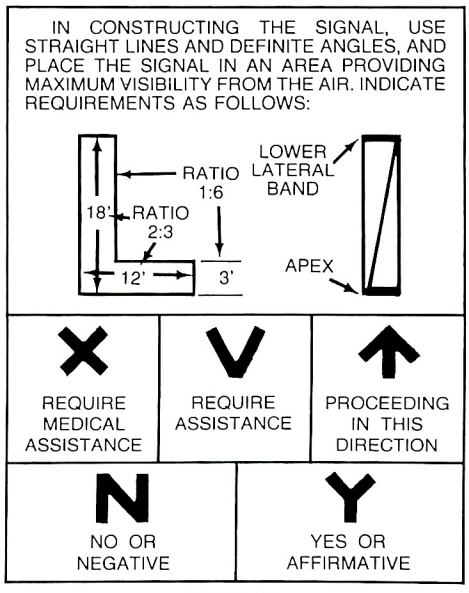

IN CONSTRUCTING THE SIGNAL, USE STRAIGHT LINES AND DEFINITE ANGLES, AND PLACE THE SIGNAL IN AN AREA PROVIDING MAXIMUM VISIBILITY FROM THE AIR. INDICATE REQUIREMENTS AS FOLLOWS:
RATIO 1:6
LOWER LATERAL BAND
18'
RATIO 2:3
12'
3'
APEX
REQUIRE MEDICAL ASSISTANCE
REQUIRE ASSISTANCE
PROCEEDING IN THIS DIRECTION
NO OR NEGATIVE
YES OR AFFIRMATIVE

Figure 2.

the pengun protect you from a threatening animal? Can you write in the snow with a smoke flare? What would you write?

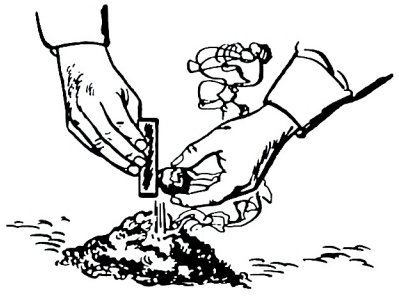
The parachute material is purposely multicolored. Do you know how to design any signals with it? (See Fig. 2.) It's a good idea to spread that chute completely out flat and stake it down in the open or over small trees and bushes. It can't be seen if wadded up and forgotten. A multicolored circle of that size can be seen from a very high altitude, especially if it contrasts with the terrain. There are 28 lines, each about 22 feet long, on it. That's 616 feet of line that can help you to form straight patterns and sharp angles over which to drape natural materials and canopy for signalling or shelter.

Firebuilding is something you will want to do right away, especially if night is rapidly approaching. Firebuilding is a very important skill, and building a successful fire quickly can be rewarding in heat, light, smoke, and protection. There are plenty of matches in the survival kit, and every one is worth its weight in gold. Don't use one without preparation and consideration of its value. Do you carry anything on your person for firebuilding in case the survival kit is lost? In this day of many nonsmokers, that's a crucial point. There are other fire starting methods of course, (see Fig. 3) but they aren't easy. Ever try one? If fire fuel is plentiful and close, build three fires. Lay them out in a triangle large enough for you to center among them. You'll stay warm on three sides then. Keep some material handy such as nylon from the parachute pack or canopy to throw on the fire when you want it to smoke as a signal. The fiberglass of the hardpan kit also burns and smokes, as will the flying helmet and its visor. You know, of course, that anything you need for another purpose (such as the helmet to keep your head warm) should not be sacrificed without a lot of thought about it.

If you are not rescued within the first few hours, you have some serious problems you need to get to work on right away. Hypothermia, dehydration and the urge to travel head the list. The urge to travel (save yourself, find help) can be overpowering. If you can't resist traveling, assess your condition, location, equipment and time very carefully. Remember, rescue parties are going to where you were, not to where you are going. Leaving the crash site, the search area or landing site is to leave behind the very things they will be looking for. Have you trekked in the wilderness? Know how? How to maneuver on steep terrain, snow and ice? Ford a stream safely? Pack and carry properly? How to avoid fatigue? How to follow a true (and clearly marked) course so those who will be following you will find you? Stay put if you can and avoid making the situation worse for you and Rescue.

Hypothermia is a real and almost unrecognizable danger in any outdoor situation, especially in temperate to cold climates where you

FLINT AND STEEL



This is the easiest and most reliable way of making a fire without matches. Use the flint fastened to the bottom of your waterproof match case. If you have no flint, look for a piece of hard rock from which you can strike sparks. If no sparks fly when it is struck with steel, find another. Hold your hands close over the dry tinder; strike flat with a knife blade or other small piece of steel with a sharp, scraping, downward motion so that the sparks fall in the center of the tinder. The addition of a few drops of gasoline before striking the flint will make the tinder flame up — FOR SAFETY, KEEP YOUR HEAD TO ONE SIDE. When tinder begins to smolder, fan or blow it gently into a flame. Then transfer blazing tinder to your kindling pile or add kindling gradually to the tinder.

One way to start a fire is with flint and lint ball.

1. Imbed a 1/4-inch piece of lighter flint (pyrophoric alloy-large size) in a 1/2"X1/4"X2" piece of soft wood or plastic. Flint should be imbedded close to one end and centered.
2. Wind 2- to 3-feet of 8-strand flax (linen) harness maker's thread at the end opposite the flint.
3. To use, unwind about 1 inch of linen, and on a smooth dry surface, scrape the strands of linen into a ball of lint using the sharp edge of a knife.
4. Place lint ball in contact with flint. With the sharp edge of the knife, use pressure and strike a spark directly into the lint ball. Lint will quickly blaze.

One of the distinct advantages of this piece of equipment is its usefulness, even after complete immersion in water. The linen dries very quickly and 5 minutes of air drying after a thorough wetting is sufficient to make it usable.

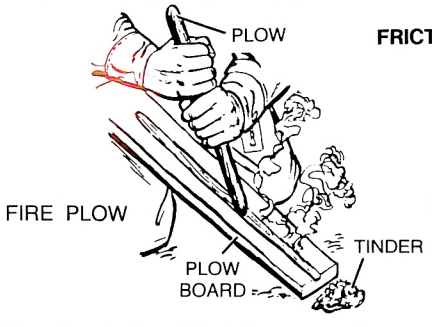
BURNING GLASS

A convex lens can be used in bright sunlight to concentrate the sun's rays on the tinder. A 2-inch lens will start a fire most any time the sun is shining. Smaller lenses will work if the sun is high and the air clear.

ELECTRIC SPARK

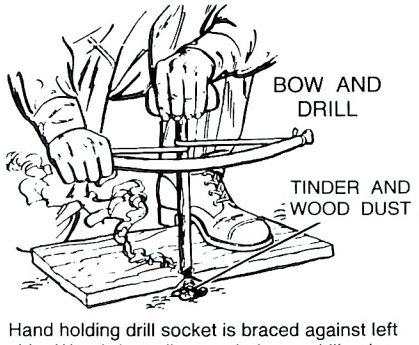
If you have a live storage battery, direct a spark onto the tinder by scratching the ends of wires together, to produce an arc.

FRICTION

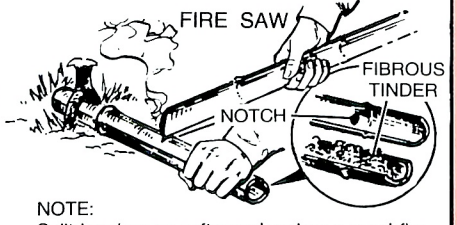


Run plow back and forth in groove with a steady but increasing rhythm until smoke in tinder indicates a spark.

Use a thong of dry rattan or other long, strong fiber, and rub with a steady but increasing rhythm.



Hand holding drill socket is braced against left shin. Wood dust piles on tinder as drill spins.



NOTE:
Split bamboo or soft wood makes a good fire saw. Dry sheath of coconut flower is a good base wood.

Figure 3.

may be affected by it before you realize it. (Read the January 1984 article on same.)

Dehydration can quietly steal your ability to function in only a few hours. The body uses almost three quarts of water per day in routine activity and few of us purposely replace it with fresh water intake in that amount. Watch out for your urine turning dark, headaches and nausea. Only a 3% loss of body fluid can rob you of 33% of your efficiency. Drink your fill at every opportunity and collect as much as you can when you can. Don't eat snow: melt it and drink the warm water.

Any survival situation can present you with every conceivable opportunity to be creative and wise, but the opposite is always at hand. The survival rescue literature is full of hair-raising tales of gross ignorance and unreasonable fear of the wilderness. There is no substitute for preparation. Prepare emotionally by finding out what frightens you and study the fear to separate it from fiction. Prepare to defend yourself against the weather and elements with proper dress and equipment. Stay prepared physically. If you can't face a few moments of hard exercise in civilization, what chance do you think you have out there?

Get rid of the *idea* that it can't happen to you! Of course it can happen to you. Think about that the next time you sortie out without your flying jacket or hooking up your survival kit or wearing that survival vest or putting a signal mirror, pack of matches, pocket knife or a few other items in pockets. They will be with you when you get on the ground even if the survival kit isn't. At least be sure someone knows when you are leaving, where you are going, and when you will be back. Know the terrain over which you fly and the expected weather conditions for the areas below for the next 24 hours. Fly safe and be prepared to stay that way.

What's New?

USA

It began in January 1972 and ended on September 15, 1983 with Major Jim Aubey accomplishing what few others have — 2000 hours flight time in the F-5. Major Aubey's road to this goal was performed in the F-5A/B Freedom Fighter and the F-5E/F Tiger II with assignments to the following squadrons:

Jan 1972 to Apr 1976 — 425 TFTS Williams AFB, Arizona

May 1976 to May 1978 — Tehran, Iran

Jun 1978 to Dec 1980 — 64/65 FWS Nellis AFB, Nevada

Jan 1981 to Jan 1982 — 527 FWS Alconberry, England

Mar 1982 to present — 425 TFTS Williams AFB, Arizona

Pictured with Major Aubey during the awards presentation are from left to right: Col. John Vickery, Commander of the 425th, Major Jim Aubey, and Lt. Col. Francis Markette, Operations Officer of the 425th.

NORTHROP
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NORTHROP F-5 TECHNICAL DIGEST

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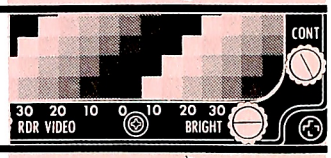

P.12 Tiger II Life Support
What you don't know or don't do can hurt you

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USA, Major Jim Aubey, 425 TFTS

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